

TABLE 3.—Solar radiation measurements, and determinations of atmospheric turbidity factor, β , Washington, D. C., December, 1932

Date and solar hour angle	Solar altitude, h .	Air mass, m .	I_m	I_r	I_p	β	Blue-ness of sky	Atmospheric dust particles per cubic centimeter	Notes: Sky-light polarization, P, clouds, etc.
1933									
Dec. 20			<i>gr. cal.</i>	<i>gr. cal.</i>	<i>gr. cal.</i>				
3:11 a.	13-18	4.28	0.870	0.654	0.585	0.050		668	
3:06 a.	13-58	4.10	.903	.660	.589	.045			
2:43 a.	16-52	3.41	.972	.778	.636	.055			
2:39 a.	17-24	3.31	.992	.779	.640	.055			
2:27 a.	18-47	3.08	1.032	.798	.657	.055			
2:23 a.	19-17	3.00	1.040	.798	.658	.055			
1:18 a.	25-04	2.35	1.187	.880	.710	.045			
1:13 a.	25-23	2.33	1.196	.883	.713	.040			
0:30 a.	27-19	2.17	1.228	.895	.704	.035			
0:26 a.	27-23	2.17	1.241	.898	.707	.030	6		P=63.2.
Dec. 22									
3:13 a.	13-00	4.37	1.002	.785	.657	.030		*1.090	
3:09 a.	13-32	4.22	1.028	.788	.660	.030			
2:32 a.	18-10	3.18	1.170	.878	.712	.025			
2:25 a.	18-58	3.06	1.185	.883	.715	.025			
0:50 a.	26-54	2.22	1.311	.935	.752	.020			
0:46 a.	26-53	2.20	1.328	.936	.505	.020	7		P=63.0.
Dec. 29									
3:03 a.	14-33	3.93	.838	.643	.553	.060		863	
2:57 a.	15-18	3.74	.861	.648	.556	.060			
1:11 a.	25-54	2.28	.959	.747	.620	.105			
1:05 a.	26-07	2.27	.987	.752	.624	.095			
0:24 a.	27-38	2.15	1.138	.895	.669	.055			
0:19 a.	27-43	2.14	1.155	.829	.672	.050	4		P=52.4.

*Local smoke.

POSITIONS AND AREAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, Superintendent United States Naval Observatory. Data furnished by Naval Observatory, in cooperation with Harvard, Perkins, and Mount Wilson Observatories. The differences of longitude are measured from central meridian, positive west. The north latitudes are plus. Areas are corrected for foreshortening and are expressed in millionths of sun's visible hemisphere. The total area, including spots and groups, is given for each day in the last column]

Date	Eastern standard civil time	Heliographic			Area		Total area for each day
		Diff. long.	Longi- tude	Latitu- de	Spot	Group	
1932							
	<i>h. m.</i>	$^{\circ}$	$^{\circ}$	$^{\circ}$			
Dec. 1 (Naval Observatory)	11 31	-46.0	69.0	+5.0		216	216
Dec. 2 (Naval Observatory)	13 21	-31.0	69.8	+5.0		123	123
Dec. 3 (Naval Observatory)	10 54	-20.0	68.9	+5.0		93	93
Dec. 4 (Naval Observatory)	12 47	No spots.					
Dec. 5 (Naval Observatory)	11 40	No spots.					
Dec. 6 (Naval Observatory)	11 5	-83.0	326.3	+10.0	370		370
Dec. 7 (Naval Observatory)	10 41	-71.0	325.4	+10.0	370		370
Dec. 8 (Naval Observatory)	11 40	-57.0	325.6	+10.0	370		370
Dec. 9 (Naval Observatory)	10 14	-43.0	327.3	+10.0	432		432
Dec. 10 (Mount Wilson)	12 0	-29.0	327.1	+10.5	609		609
Dec. 12 (Perkins Observatory)	12 35	+2.0	331.5	+10.0		90	90
Dec. 13 (Mount Wilson)	14 15	-9.0	306.4	+11.0		10	10
		+12.0	327.4	+10.0	506		516
Dec. 15 (Naval Observatory)	10 50	+37.0	327.9	+10.0		293	293
Dec. 16 (Naval Observatory)	11 25	+51.0	328.4	+10.0		401	401
Dec. 17 (Mount Wilson)	13 50	+56.0	319.0	+9.0	6		446
		+66.0	329.0	+10.0		440	440
Dec. 18 (Naval Observatory)	13 13	+67.0	317.0	+9.0		123	123
		+80.0	330.0	+10.0		370	493
Dec. 19 (Perkins Observatory)	13 35	+72.0	308.6	+10.5		90	90
Dec. 20 (Naval Observatory)	10 46	+86.0	311.0	+12.0		309	309
Dec. 21 (Mount Wilson)	12 15	+89.0	300.0	+12.0		103	103
Dec. 22 (Naval Observatory)	10 53	No spots					
Dec. 23 (Naval Observatory)	11 1	No spots.					
Dec. 24 (Perkins Observatory)	14 50	No spots.					
Dec. 25 (Perkins Observatory)	15 0	No spots.					
Dec. 26 (Perkins Observatory)	14 10	No spots.					
Dec. 27 (Mount Wilson)	12 25	+20.0	151.9	+8.0		49	49
Dec. 28 (Perkins Observatory)	16 20	No spots					
Dec. 29 (Naval Observatory)	11 17	+50.0	156.2	+8.0	31		31
Dec. 30 (Mount Wilson)	12 15	+62.0	154.5	+6.0		50	50
Mean daily area for Decem- ber							195

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR DECEMBER, 1932

(Dependent alone on observations at Zurich and its station at Arosa)

[Data furnished through the courtesy of Prof. W. Brunner, University of Zurich, Switzerland]

December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers	December, 1932	Relative numbers
1		6	<i>d</i> 8	11	15	16	13	21	0	26	0
2	13	7	10	12	<i>b</i> 22	17	18	22	0	27	<i>Mc</i> 10
3	13	8	11	13	23	18	20	23	0	28	10
4	10	9	13	14	16	19	19	24	0	29	9
5	8	10	13	15	15	20	16	25	0	30	9
										31	8

Mean: 30 days=10.7.

a= Passage of an average-sized group through the central meridian.*b*= Passage of a large group or spot through the central meridian.*c*= New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central zone.*d*= Entrance of a large or average sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, W. R. Gregg, in charge]

By L. T. SAMUELS

Free-air temperatures during December were above normal over the Lake region and southern stations and below normal over the western and northern stations. (Table 1.) The largest positive departures occurred over Atlanta and the largest negative departures over Ellendale.

The mean free-air relative humidities were above normal except at Omaha where the negative departures increased with elevation. The largest positive departures occurred at the southern stations.

Free-air resultant wind directions in the lower levels were close to normal except in the southeastern states where the resultants showed pronounced southerly components. At the higher levels the resultant directions were close to normal except on the Pacific coast where they showed pronounced northerly components. Resultant velocities in most cases were greater than normal at all levels.

TABLE 1.—Free-air temperatures and relative humidities during December, 1932

TEMPERATURE (° C.)

Altitude (meters) m. s. l.	Atlanta, Ga. (303 meters) ¹		Boston, Mass. (6 meters) ²		Chicago, Ill. (187 meters) ³		Cleveland, Ohio (246 meters) ³		Dallas, Tex. (146 meters) ⁴		Ellendale, N. Dak. (444 meters)		Omaha, Nebr. (300 meters) ⁶		Pensacola, Fla. (2 meters) ⁸		San Diego, Calif. (9 meters) ⁵	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	8.3	(7)	-0.4	-----	-3.6	(7)	-1.0	(7)	3.6	(7)	-10.8	-1.3	-8.2	(7)	12.3	+1.1	10.6	-3.5
500	8.7	(7)	-0.2	-----	-2.7	(7)	-0.6	(7)	4.8	(7)	-10.3	-9	-6.7	(7)	13.5	+2.4	10.8	-2.5
1,000	9.8	+3.2	-1.2	-----	-3.0	+0.5	-1.3	+2.2	4.9	-1.8	-7.7	-7	-4.3	-1.4	12.5	+1.8	10.4	-2.0
1,500	9.1	+3.7	-1.2	-----	-3.6	+1	-2.5	+1.2	6.5	+5	-8.2	-1.7	-3.6	-1.0				
2,000	7.7	+3.9	-2.9	-----	-4.5	+4	-3.2	+1.7	5.9	+1.4	-10.2	-2.6	-4.6	-6	8.7	+6	6.8	-1.8
2,500	5.3	+3.5	-4.4	-----	-5.5	+1.2	-4.7	+2.0	3.9	+1.4	-12.5	-2.9	-6.6	-3				
3,000	2.8	+3.2	-7.1	-----	-8.1	+8	-6.5	+2.4	1.4	+1.1	-15.6	-3.5	-8.3	+4	4.4	+4	2.6	-1.4
4,000	-2.8	+2.7	-12.5	-----	-13.7	+1.1	-11.3	+3.5	-3.9	+1.1	-22.2	-4.6	-14.3	-4	-5	+4	-2.6	-9
5,000	-9.2	+2.9	-18.1	-----	-19.8	+9	-17.9	+2.8	-11.2	-7			-20.4	-1.0			-8.8	-7

RELATIVE HUMIDITY (PER CENT)

Surface	88	(7)	66	84	(7)	78	(7)	83	(7)	81	0	83	(7)	89	+5	74	+14
500	85	(7)	61	79	(7)	74	(7)	77	(7)	79	0	78	(7)	86	+6	67	+12
1,000	72	+11	57	73	+6	69	+2	70	+14	67	+2	63	0	76	+8	63	+17
1,500	65	+9	51	66	+9	67	+10	60	+13	61	+3	52	-5				
2,000	59	+7	46	60	+8	59	+7	54	+14	61	+6	45	-10	71	+15	51	+18
2,500	55	+8	44	54	+3	55	+4	50	+13	62	+7	42	-14				
3,000	53	+11	42	51	+1	54	+4	50	+16	66	+12	39	-18	63	+10	41	+16
4,000	50	+9	41	50	-2	51	-1	31	-3	59	+6	40	-17	59	+10	33	+13
5,000	47	+6	40	48	-1	51	+2	29	-4			34	-23			25	+9

¹Temperature and humidity departures based on normals of Due West, S. C.² Observations made by Massachusetts Institute of Technology

^a Temperature and humidity departures based on normals of Royal Center, Ind.

[†] Temperature and humidity departures based on normals of Royal Center, Ind.

⁵ Naval air stations.

⁶ Temperature and humidity departures based on normals of Drexel, Nebr.

⁷ Surface and 500-meter departures omitted because of difference in time between airplane observations and those of kites upon which the normals are based.

Weather Bureau airplane observations made near 5 a. m.; Navy airplane observations near 7 a. m.; Ellendale kite observations near 9 a. m. (seventy-fifth meridian time).

TABLE 2.—Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during December, 1932

[Wind from N=360°; E=90°, etc.]

[illegible]

AEROLOGICAL OBSERVATIONS FOR THE YEAR 1932

[Aerological Division, W. R. Gregg, in charge]

By L. T. SAMUELS

Free-air temperatures during the year averaged above normal except at San Diego and in the lower levels at Ellendale, Norfolk, and Washington (Table 1). Free-air relative humidities averaged mostly above normal except at Omaha and Washington.

Kite flying was discontinued at Due West, S. C., during May and an airplane observation station established at Atlanta, Ga., during July. Pilot-balloon observations were made from two to four times daily at 75 Weather Bureau stations at the end of the year as compared to 70 stations at the beginning of the year. The

average number of daily soundings at these stations was 246.

In connection with the International Polar Year program (August, 1932, to August, 1933), 91 sounding-balloon observations were made at 3 stations between August and December. Seventy-one of the meteorographs sent up in these observations have been found and returned. The records indicate that the balloons entered the stratosphere in nearly every case. The special station established at Point Barrow, Alaska, for the Polar Year has reported a total of 200 pilot-balloon observations from September 15, to the end of 1932; more than 900 cloud observations and more than 2000 photographs of the aurora. Five airplane observations to between 5 and 6 km are being made monthly at Fairbanks, Alaska, during the Polar Year period.

TABLE 1.—Free-air temperatures and relative humidities during the year 1932

Altitude (meters) m. s. l.	Chicago, Ill. (187 meters) ¹		Cleveland, Ohio (246 meters) ¹		Dallas, Tex. (146 meters) ²		Ellendale, N. Dak. (444 meters)		Norfolk, Va. (3 meters) ³		Omaha, Nebr. (300 meters) ⁴		Pensacola, Fla. (2 meters) ⁵		San Diego, Calif. (9 meters) ³		Washington, D. C. (2 meters) ³	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface.....	6.8	(9)	7.4	(9)	14.2	(9)	5.2	-0.4	14.1	-0.5	6.3	(9)	18.4	+0.2	16.1	-1.8	10.9	-1.6
500.....	7.6	(9)	8.5	(9)	15.9	(9)	5.1	-4	12.9	-8	7.2	(9)	17.8	+6	14.2	-1.5	10.9	-1
1,000.....	6.8	+0.2	7.2	+0.6	15.2	+1.2	4.5	-1	11.0	-6	8.6	+0.6	16.0	+8	15.2	-7	9.9	+7
1,500.....	5.1	+5	4.9	+3	13.4	+1.2	3.4	+2			7.6	+1.0						
2,000.....	3.1	+6	2.9	+4	11.0	+1.0	1.3	+3	6.9	-1	5.9	+1.5	11.8	+1.0	12.2	-0.3	6.2	+1.1
2,500.....	.8	+6	.7	+5	8.4	+9	-1.1	+6			3.3	+1.5						
3,000.....	-1.6	+7	-1.7	+6	5.8	+9	-3.8	+5	-2.7	+4	.5	+1.5	7.0	+1.0	6.7	-1	2.1	+1.3
4,000.....	-7.3	+3	-7.3	+3	-.3	+4	-9.3	+7	-2.2	+7	-5.9	+9	2.1	+2.0	.7	0	-3.1	+1.6
5,000.....	-13.8	-3	-14.0	-5	-6.9	-6	-14.9	+8	-8.3	+5	-12.7	+1	-3.0	+1.9	-6.1	0	-8.5	+1.0

RELATIVE HUMIDITY (PER CENT)																		
Surface.....	78	(9)	81	(9)	80	(9)	73	+1	73	+1	82	(9)	83	+2	71	+4	71	+2
500.....	70	(9)	74	(9)	69	(9)	72	+1	69	+5	75	(9)	76	+3	71	+4	62	-1
1,000.....	63	-2	70	+5	62	0	66	+2	64	+4	60	-1	72	+5	53	+2	56	-3
1,500.....	59	-1	68	+8	59	+5	62	+3			55	-2						
2,000.....	56	0	62	+6	56	+8	61	+4	58	+5	51	-4	63	+6	36	+2	52	-4
2,500.....	54	+2	57	+5	52	+7	59	+3			51	-4						
3,000.....	50	0	53	+3	49	+7	59	+4	51	+5	51	-4	57	+8	30	+2	45	-3
4,000.....	46	0	48	+2	46	+7	53	0	48	+6	49	-4	54	+5	26	+1	37	-9
5,000.....	43	-1	46	+2	45	+10	51	+1	47	+10	45	-7	55	+8	22	-1	27	-7

¹ Temperature and humidity departures based on normals of Royal Center, Ind.² Temperature departures based on normals determined by interpolating between those of Groesbeck, Tex., and Broken Arrow, Okla. Humidity departures based on normals of Groesbeck, Tex.³ Naval air stations.⁴ Temperature and humidity departures based on normals of Drexel, Nebr.⁵ Surface and 500-meter departures omitted because of difference in time between airplane observations and those of kites upon which the normals are based.

Weather Bureau airplane observations made near 5 a. m.; Navy airplane observations near 7 a. m.; Ellendale kite observations near 9 a. m. (75th meridian time).

RIVERS AND FLOODS

By RICHMOND T. ZOCH

[River and Flood Division, Montrose W. Hayes, in charge]

In December, 1932, floods occurred on the Atlantic Slope from southern Virginia southward to southern Georgia, in the East Gulf of Mexico States, in the Ohio Basin, and in the tributaries of the Mississippi River south of Cairo. None of them reached a height in December that would make them of major importance, except the one in the Pearl River of Mississippi, which is described as follows by the official in charge of the Weather Bureau office in Meridian, Miss.:

December was wet throughout the basin of the Pearl River. There were two periods of particularly heavy precipitation. The first, in which the greatest falls occurred, was from the 9th to the 16th; the excesses were most marked in the upper basin of the Pearl. The second was from the 24th to the 28th. Notably heavy precipitation occurred at Canton, where the amount from

the 9th to the 16th was 8.70 inches, and for the month was 13.37; at Edinburg, where the amount from the 9th to the 16th was 12.41, and for the month was 17.44; and at Jackson, where 9.16 occurred from the 9th to the 16th, and 14.50 occurred in the entire month.

Freezing temperatures prevailed from the night of the 15th through the night of the 19th. The rain in this period froze as it fell and the result was equivalent to the holding back of the water from a rainstorm amounting to about two inches, which would have entered the Pearl River at Jackson, and immediately above, at the time of crest stages. This retarding of the run-off reduced the flood heights that would have occurred had the temperatures been above freezing. A thaw began during the forenoon of the 20th and continued through the night of the 20th-21st, and all ice had disappeared by the morning of the 21st. The water released by the thaw entered a falling river, and merely retarded the rate of fall.

At Jackson the flood was the severest since May 30, 1909, when the crest was 35.3 feet. The highest stage of record at Jackson